

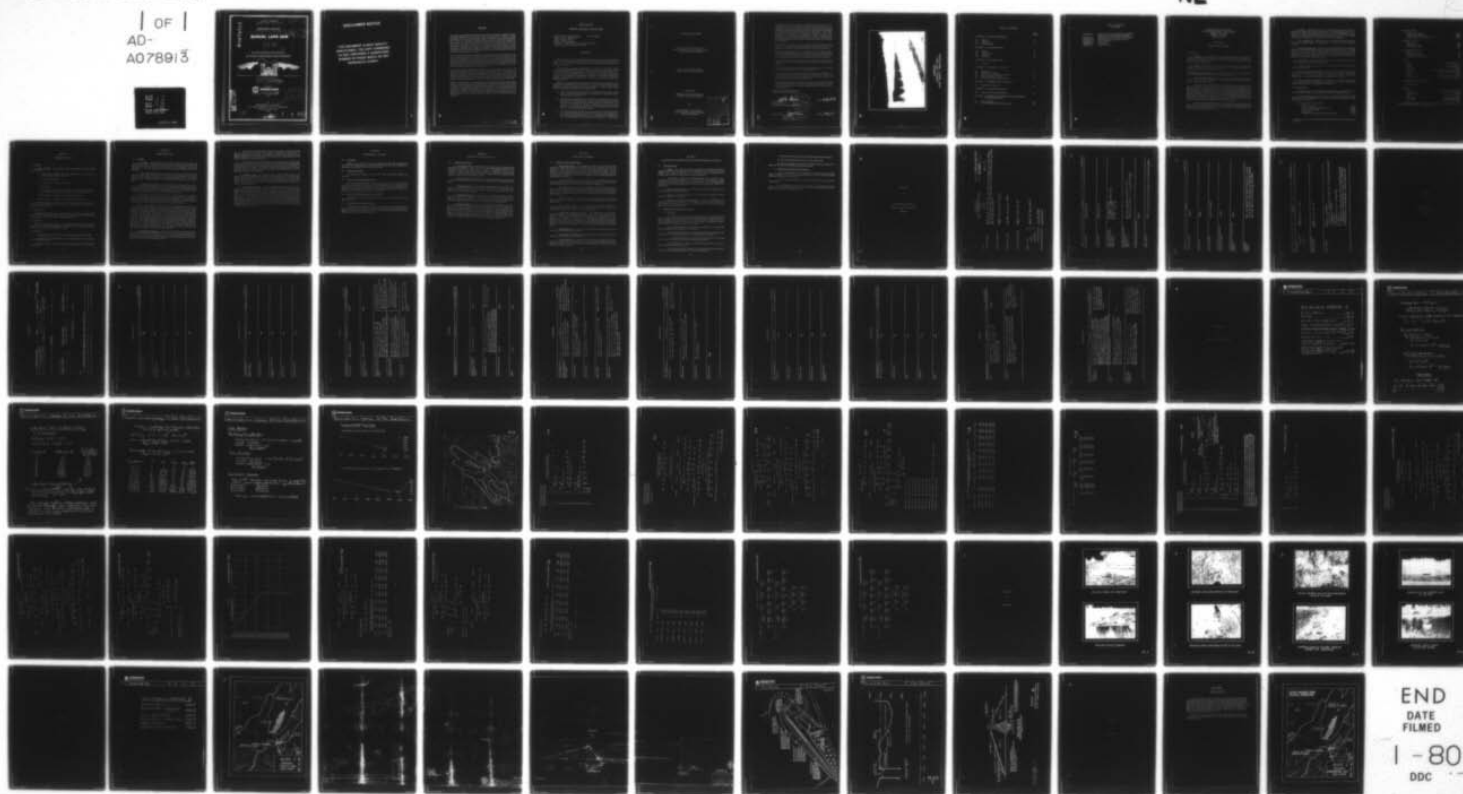
AD-A078 913

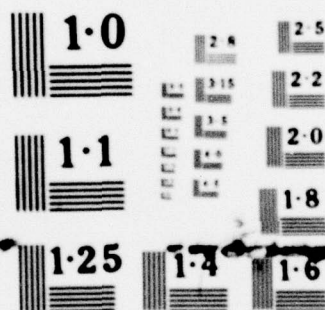
O'BRIEN AND GERE ENGINEERS INC PHILADELPHIA PA JUSTIN--ETC F/6 13/13  
NATIONAL DAM INSPECTION REPORT. MARCEL LAKE DAM. NDI - PA 00402--ETC(U)  
MAR 79 DACW31-79-C-0010

UNCLASSIFIED

1 OF 1  
AD-  
A078913

NL





NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

ADA078913

DELAWARE RIVER BASIN  
DINGMANS CREEK, PIKE COUNTY,

PENNSYLVANIA.

*(6) National Dam Inspection Report*  
**MARCEL LAKE DAM**

NDI - PA 00402,  
PA DER 52-149.

PHASE I INSPECTION REPORT,  
NATIONAL DAM INSPECTION PROGRAM



Distribution Unlimited  
Approved for Public Release  
Contract No. DACW31-79-C-0010

Prepared By



**O'BRIEN & GERE, Inc.**

Justin & Courtney Division  
PHILADELPHIA, PENNSYLVANIA  
19103

DDC

RECEIVED  
JAN 8 1980

ORIGINAL CONTAINS COLOR PLATES; ALL DDC  
REPRODUCTIONS WILL BE IN BLACK AND WHITE  
FOR

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT CORPS OF ENGINEERS  
BALTIMORE, MARYLAND

21203

DDC FILE COPY

1280

11 MAR 80 - 79

7 1 026  
410 760 mt

## **DISCLAIMER NOTICE**

**THIS DOCUMENT IS BEST QUALITY  
PRACTICABLE. THE COPY FURNISHED  
TO DDC CONTAINED A SIGNIFICANT  
NUMBER OF PAGES WHICH DO NOT  
REPRODUCE LEGIBLY.**



## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

## PHASE I REPORT

### NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Marcel Lake Dam                      ID # PA-00402  
State Located: Pennsylvania  
County Located: Pike  
Stream: Dingman's Creek  
Coordinates: Latitude 41° 15.2' Longitude 74° 57.4'  
Date of Inspection: November 22, 1978

### ASSESSMENT

Marcel Lake Dam is an earth embankment dam with a concrete overflow spillway. The dam is approximately 675 feet long and has a maximum height of 23 feet. The dam is located along legislative route 51006 about 1 mile east of the village of Edgemore.

The spillway is capable of discharging 40 percent of the PMF without overtopping of the earth embankment. Failure of the dam for 50 percent of the PMF was determined to significantly increase the hazard to loss of life downstream of the dam. Therefore, the spillway is classified as "seriously inadequate", and the dam is classified as "unsafe (non-emergency)". Detailed hydrologic and hydraulic analyses should be performed to determine the need for increasing the spillway capacity.

Based on visual observations and review of the information obtained from the Pennsylvania Department of Environmental Resources, Dam Safety Section, Marcel Lake Dam is considered to be in poor condition. Conditions that require further investigation, maintenance, or monitoring are:

1. Longitudinal depressions extend across the upstream face and the top of dam. These depressions should be monitored to determine if any differential movement occurs.
2. Immediately downstream of the embankment is a swampy area covering approximately 12,000 square feet. The wet area is covered by a high, thick cover of grass, and areas of standing water 6 to 12 inches deep. In many areas the water is discolored with brown and rusty colored deposits. This swampy area should be monitored regularly for any signs of increased seepage and/or turbid water.
3. The depressions along the upstream face and the top of dam, the seepage and discolored standing water at the toe of the dam, and undulations of all of the embankment surfaces may be indicative of the migration of fine material through the embankment or foundation. A subsurface

DELAWARE RIVER BASIN

Name of Dam: Marcel Lake Dam  
County & State: Pike County, Pennsylvania  
Inventory Number: PA 00402

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.  
JUSTIN & COURTNEY DIVISION

For:

DEPARTMENT OF THE ARMY  
Baltimore District, Corps of Engineers  
Baltimore, MD 21203

Accession For	
NTIS GMA&I	<input checked="checked" type="checkbox"/>
DDC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist.	Avail and/or special
A	23

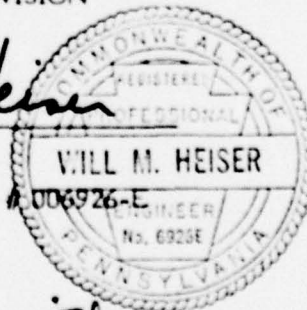


investigation should be initiated at several sections of the dam to include, but not be limited to, soil borings for determination of the composition and in situ properties of the embankment and foundation materials. Piezometers should be installed in the boreholes to evaluate pore pressure development throughout the embankment. The investigation should be supervised by a licensed professional engineer with experience in the design and construction of dams. Results of the investigation should be used to establish if the materials are satisfactory for the embankment as designed and constructed; and to detect possible fines migration.

4. Approximately 400 feet of the top of dam is depressed below design elevation. All areas below design elevation should have additional fill placed and compacted to regrade the embankment to design elevation.
5. The riprap slope protection for the upstream face is poorly graded, unevenly distributed, and does not provide an adequate coverage area. The riprap should be supplemented with large and medium sized rock to provide a well graded, even layer of riprap to extend to the top of dam.
6. Animal burrow holes were noted on both the upstream and downstream slopes of the dam. These holes should be filled with suitable earth materials.
7. The dam is partially overgrown with bushes and trees up to 15 feet high. The trees and bushes should be cut at the ground level.
8. The conditions of the site show evidence of lack of maintenance. A program of periodic maintenance should be established to include, but not be limited to, mowing the grass, exercising the gate valve, and inspecting the dam for structural deficiencies.
9. No flood warning system is in effect at this site. A downstream warning system should be developed, and during periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

O'BRIEN & GERE ENGINEERS, INC.  
JUSTIN & COURTNEY DIVISION

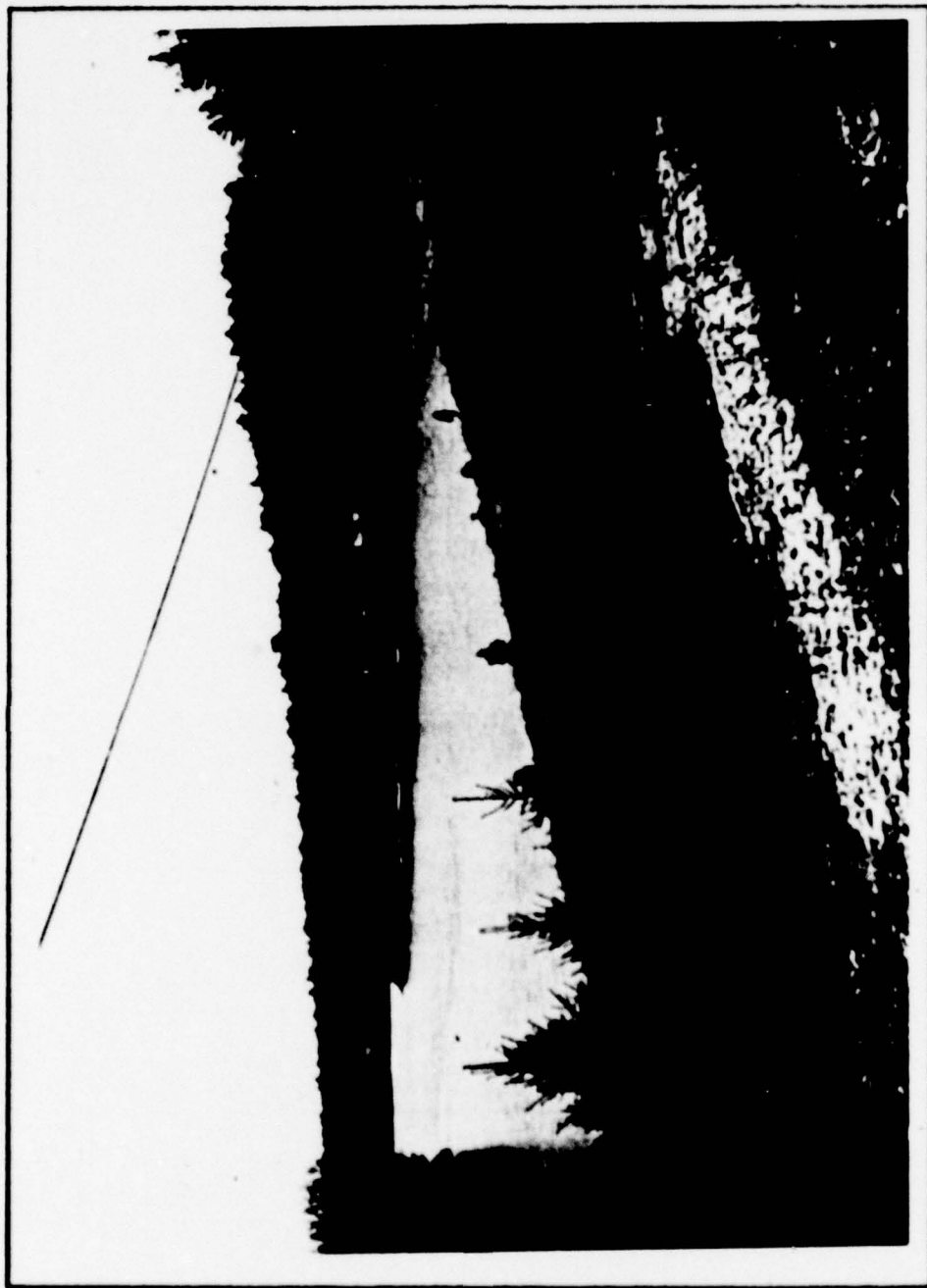
*Will M. Heiser*  
Will M. Heiser, P.E.  
Vice-President  
Pennsylvania Registration # 006926-E



Date: 16 Apr 1979

Approved by: *G.K. Withers*  
G.K. WITHERS  
Colonel, Corps of Engineers  
District Engineer

Date: 14 May 1979



OVERVIEW  
MARCEL LAKE DAM  
PIKE COUNTY, PENNSYLVANIA



## TABLE OF CONTENTS

	<u>PAGE</u>
SECTION 1 - PROJECT INFORMATION	
1.1 General	1
1.2 Description	1
1.3 Pertinent Data	2
SECTION 2 - ENGINEERING DATA	
2.1 Design	4
2.2 Construction	4
2.3 Operation	4
2.4 Evaluation	4
SECTION 3 - VISUAL INSPECTION	
3.1 Findings	5
SECTION 4 - OPERATIONAL FEATURES	
4.1 Procedures	7
4.2 Maintenance of Dam	7
4.3 Maintenance of Operating Facilities	7
4.4 Warning System in Effect	7
4.5 Evaluation of Operational Adequacy	7
SECTION 5 - HYDRAULICS AND HYDROLOGY	
5.1 Evaluation of Features	8
SECTION 6 - STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	9
SECTION 7 - ASSESSMENT, RECOMMENDATIONS, PROPOSED REMEDIAL MEASURES	
7.1 Dam Assessment	10
7.2 Recommendations, Remedial Measures	10

TABLE OF CONTENTS  
(Continued)

APPENDIX A -	CHECKLIST, ENGINEERING DATA, DESIGN CONSTRUCTION, OPERATION, PHASE I
APPENDIX B -	CHECKLIST, VISUAL INSPECTION, PHASE I
APPENDIX C -	HYDROLOGIC & HYDRAULIC DATA
APPENDIX D -	PHOTOGRAPHS
APPENDIX E -	DRAWINGS
APPENDIX F -	SITE GEOLOGY

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
MARCEL LAKE DAM  
NDI I.D. # PA-00402  
DER # 52-149

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. This inspection was performed pursuant to the authority granted by the National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to evaluate the structural and hydraulic conditions of the Marcel Lake Dam, and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project (Information obtained from the Pennsylvania Department of Environmental Resources (DER), Dam Safety Section).

*ABSTRACT*  
a. Dam and Appurtenances. Marcel Lake Dam is an earth fill embankment with a clay core. The embankment is approximately 675 feet long with a maximum height of about 23 feet.

A 60-foot long overflow spillway is located between the embankment and the left abutment. The dam was designed with 6.5 feet of freeboard above the spillway crest. Training walls extend a short distance upstream and downstream of the spillway, and riprap slope protection is provided along the banks of the approach channel. A reinforced concrete apron extends approximately 20 feet downstream of the spillway. The apron varies in width, from 60 feet at the base of the spillway to 25 feet at the junction with a grouted riprap lined channel. The channel has a 25-foot base width and side slopes of 1 horizontal to 1 vertical (1H:1V), and extends about 150 feet downstream of the apron.

A 30-inch corrugated metal pipe encased in concrete is provided as a low level outlet. Discharge through the pipe is controlled by a hand-wheel operated sluice gate on the outlet structure. The outlet structure is located at the toe of the upstream face of the embankment.

*ABSTRACT*



b. Location. Marcel Lake Dam is located across Dingman's Creek in Delaware Township, Pike County, Pennsylvania. The site is approximately 1 mile east of the village of Edgemere, and is shown on USGS quadrangle entitled, "Edgemere, Pennsylvania" at coordinates N 41° 15.2', E 74° 57.4'. A regional location plan of Marcel Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. Marcel Lake Dam has a maximum height of 23 feet and a normal storage volume of 160 acre-feet. The dam is in the small size category.

d. Hazard Classification. Several commercial establishments are located along Dingman's Creek approximately 1.5 miles downstream of the dam. A large number of homes are located near Dingman's Creek from 2 to 2.5 miles downstream of the dam. Failure of the Marcel Lake Dam would cause extensive property damage and probable loss of human lives. Therefore, the dam is in the high hazard category (See paragraph 3.1.e).

e. Ownership. The dam is owned by All-American Realty Company, Inc., 45 Essex Street, Hackensack, New Jersey, 07602.

f. Purpose of Dam. Marcel Lake Dam was constructed for recreation and real estate development.

g. Design and Construction History (From information obtained from DER). The dam was originally designed by Mr. John B. Fredenstein of Matamoras, Pennsylvania. The design was altered by Edward C. Hess of Stroudsburg, Pennsylvania. Construction of the dam was completed in June, 1961.

h. Normal Operating Procedures. The reservoir is normally maintained at the spillway crest elevation. Inflow occurring when the reservoir is at or above the spillway crest elevation is discharged over the spillway.

### 1.3 Pertinent Data

a. Drainage Area. The drainage area above the dam is 4.2 square miles, as taken from information provided by DER and verified on topographic maps.

b. Discharges at Dam Site. No high pool or discharge records were made available. The spillway capacity at the design top of dam is approximately 3,480 cubic feet per second (cfs).

c. Elevation (Feet - USGS Datum)\*

Design top of dam	1237.5
Low spot - top of dam (approximate)	1236.5
Maximum pool ( $\frac{1}{2}$ PMF)	1237.0
Normal pool	1231.0
Streambed at centerline of dam (approximate)	1214.0

\* Elevations shown on the design drawings appear to differ from USGS datum by 25 feet.

d. Reservoir (feet)

Length of normal pool	2,600
Length of pool (top of dam)	2,800
Length of pool (low spot-top of dam)	2,780

e. Storage (acre-feet)

Normal pool	160
Design top of dam	325
Low spot-top of dam	293

f. Reservoir Surface (acres)

Design top of dam	33
Low spot-top of dam	32
Normal pool (spillway crest)	27

g. Dam

Type	earth embankment
Length	675 feet +
Height	23 feet (maximum)
Top width	12 feet
Side slopes	3H:1V (upstream), 2H:1V (downstream)
Zoning	earth fill and core material
Impervious core	clay
Cutoff	key trench with core material
Grout Curtain	none shown on drawings

h. Diversion and Regulating Tunnel

Not applicable

e. Spillway

Type	concrete overflow section
Length of weir	60 feet
Crest elevation	1,231 feet above MSL
Gates	none
U/S channel	riprap lined approach
D/S channel	grouted riprap channel

j. Regulating Outlets. The outlet is a 30 inch corrugated metal pipe controlled by a sluice gate in the outlet structure.



## SECTION 2

### ENGINEERING DATA

#### 2.1 Design

a. Data Available. The engineering data made available by DER includes the following:

1. "Application", "Report Upon the Application", and "Permit" to construct Marcel Lake Dam, 1960.
2. Construction drawings.
3. Contract provisions and specifications.
4. Photographs.
5. "Application for Permit to Draw Dam or Other body of Water in Accordance with the Act of December 15, 1959" (5 applications).
6. Miscellaneous correspondence, inspection report, etc.

Note: No design calculations were made available for review.

b. Design Features. The principal design features for the structure are shown on the drawings enclosed in Appendix E. A description of the features is discussed in Section 1.2.a.

#### 2.2 Construction

The construction information made available was limited to several photos and a letter from Edward Hess concerning revisions made to conform to requirements of the Division of Dams and Encroachments.

#### 2.3 Operation

No formal operating procedures were included in the information obtained from DER. The owner's representative stated that he was not aware of any operational procedures associated with the dam.

#### 2.4 Evaluation

a. Availability. All information made available was obtained from DER.

b. Adequacy. The design drawings made available appear to be adequate for a Phase I investigation.

c. Validity. There is no reason to question the validity of the data obtained from DER.

## SECTION 3

### VISUAL INSPECTION

#### 3.1 Findings

a. General. The field inspection of Marcel Lake Dam took place on November 22, 1978. At the time of inspection, the reservoir water surface was approximately one inch above the spillway crest. No underwater areas were inspected. The dam was found to be constructed in general conformance with the drawings.

b. Dam. The upstream face of the dam is covered by small poorly graded riprap. There is little uniformity in the distribution and placement of the rock. The riprap extends only three feet above the normal pool elevation. The entire upstream face is heavily overgrown with weeds, bushes, and trees up to 15 feet high.

Undulating depressions were observed along the upstream face of the dam. The depressions extended from the top of dam to beneath the water surface in some locations, and extended in depth to more than 2 feet. Field measurements of the slope of the upstream face indicate local variations from 2H:1V to 4H:1V. Several animal burrow holes were noted along the upstream face.

The downstream face and the top of dam are characterized by undulating surfaces, heavy grass cover, burrow holes, and occasional small trees and bushes. Review of the top of dam survey reveals that about 400 feet of the top of dam is below design elevation (See Plate 5 of Appendix E). Measurements of the slope of the downstream face revealed variations of from 1.7H:1V to 2H:1V.

A swampy area extends from the toe of the embankment (See Plate 4 of Appendix E) for 50 to 100 feet, and along the toe from within 75 feet of the right abutment to the outlet channel. The swampy area contains approximately 12,000 square feet of saturated ground with areas of standing water 6 to 12 inches deep. In many areas, the water was discolored with brown and rusty colored deposits. The area was covered by a high, thick grass cover with clumped roots. Seepage from this area could be observed along the riprapped right bank of the outlet channel. Localized outflows of up to 15 gallons per minute (gpm) were observed, with the total outflow from the swampy area estimated at 300 to 400 gpm. Approximately 75 feet downstream of the embankment toe, an 8 inch diameter PVC pipe is constructed through the right bank of the outlet channel into the swampy area. Discharge from the pipe was estimated at 50 gpm. The origin and the purpose of the pipe could not be readily determined.

c. Appurtenant Structures. The 5-foot high concrete overflow spillway adjoins the left abutment of the dam, with concrete training walls extending both upstream and downstream of the spillway. Some minor surface spalling of concrete was noted along the training walls. The spillway approach channel is protected on both banks with a thick cover of large riprap.

An apron is constructed downstream of the spillway. The apron extends about 15 feet, and is constructed on a grade of approximately 10 percent. A grouted riprap channel with 1H:1V side slopes and a 25-foot base width extends for 200 feet downstream of the apron, with a 70-foot transition reach where the base width is reduced from 60 feet to 25 feet.

The intake for the low level outlet is a concrete structure located about 60 feet upstream of the crest of the embankment. The structure was inaccessible at the time of inspection, but appeared to be in good condition. The handwheel for the sluice gate was in place. The owner's representative didn't know if the sluice gate was operable. The outlet headwall structure at the downstream toe of the embankment was in good condition.

d. Reservoir Area. The drainage area is predominantly meadow and woodland, with some residential development near Marcel Lake. A natural lake (Silver Lake) is located about 1.5 miles upstream of Marcel Lake. Approximately 36 percent of the basin is located upstream of the Lake Rene Dam, as shown on Plate 1 of Appendix E. Lake Rene Dam is approximately 1,000 feet long, with a 55-foot concrete spillway.

e. Downstream Channel. The Lake Massad Dam is located on Dingman's Creek approximately 4,000 feet downstream (stream distance) of Marcel Lake. Between the two dams, Dingman's Creek is moderately wooded on both overbanks. There is no development within the extent of potential flooding for this reach. The spillway of Lake Massad Dam is 100 feet wide, with a freeboard of 5 feet above normal pool. The potential hazard area is located approximately 500 feet downstream of the Lake Massad Dam, where Dingman's Creek parallels Legislative Route 51006. Several stores are located along the left bank of the stream, near the Lake Massad Dam, and many residences are located along both banks of the Dingman's Creek for the next mile. Approximately 30 homes and up to 500 people could be affected in this area.



## SECTION 4

### OPERATIONAL FEATURES

#### 4.1 Procedures

Based on the review of information provided by DER, and a conversation with the owner's representative, no formal operating procedures are established for operation and maintenance of the Marcel Lake Dam.

#### 4.2 Maintenance of Dam

The owner's representative was not aware of any maintenance program for the dam.

#### 4.3 Maintenance of Operating Facilities

The only operating facility associated with the dam is the handwheel operated sluice gate of the low level outlet. The handwheel was in place, but was inaccessible at the time of inspection. Therefore, the operating condition of the drawdown facilities could not be assessed. The owner's representative did not know if the operating facilities were periodically exercised.

#### 4.4 Description of any Warning System in Effect

According to the owner's representative, no flood warning system is in effect at this site.

#### 4.5 Evaluation of Operational Adequacy

The operational condition of the gate valve should be evaluated by periodic exercise of the system. The grass should be mowed at least twice annually. During periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

## SECTION 5

### HYDRAULICS AND HYDROLOGY

#### 5.1 Evaluation of Features

a. Design Data. Marcel Lake Dam has a drainage area of 4.2 square miles and impounds a reservoir of 160 acre-feet. The dam was designed with 6.5 feet of freeboard, although the field survey revealed a depressed section of the embankment to be one foot below design elevation. The spillway is a 60-foot long concrete overflow structure with a maximum design capacity of approximately 3,680 cfs (2,860 cfs to the surveyed low spot).

b. Experience Data. According to the owner's representative, no discharge or reservoir stage records are maintained for this site, and no estimate could be given.

c. Visual Observations. The Spillway Design Flood (SDF) for this site is given as a range from one-half of the PMF to the full PMF. Based on the dam height and storage capacity and the distance to the hazard area, the SDF was determined to be one-half of the PMF.

d. Overtopping Potential. The peak inflow and outflow rates for the SDF were determined to be 3,770 cfs and 3,750 cfs respectively. Based on the hydrologic analyses, the spillway is capable of discharging 40 percent of the PMF without overtopping of the embankment (See Appendix C for computations).

e. Spillway Adequacy. A dam break analysis was performed to evaluate the "hazard to loss of life downstream from the dam from that which would exist just before overtopping failure" (ETL 1110-2-234, 10 May, 1978). According to the analysis, failure of the Marcel Lake Dam would increase the depth of overbank flow from 2.5 feet to 3.1 feet for 50 percent of the PMF. The peak discharge at the hazard area would increase from 3,740 cfs to 4,830 cfs. Failure of the dam is considered to significantly increase the hazard to loss of life. Therefore, the spillway of the Marcel Lake Dam is classified as "seriously inadequate".



## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

a. Visual Observations. The undulating surface of the top of dam and downstream slope, the longitudinal depressions along the upstream face, and the depression of the right side of the top of dam could be the result of poor compaction during construction. Based on the presence of seepage, and an extensive area of discolored standing water downstream of the toe, the undulations and depressions could also be due to the migration of fine material through the embankment or foundation.

The roots of trees growing on the dam may increase the seepage potential through the embankment and uprooting of the trees by high winds could cause substantial volumes of embankment material to be displaced.

The riprap does not provide for adequate protection of the upstream face of the dam. The riprap is poorly graded and unevenly distributed. In addition, the coverage extends only 3 feet above normal pool elevation. The inadequate riprap cover could be partially responsible for the depressions along the upstream face of the dam.

Animal burrow holes observed on both the upstream and downstream slopes could have a deleterious affect upon the seepage potential through the embankment.

The concrete spillway shows no signs of structural instability or deterioration of concrete surfaces. According to the design drawings, reinforcing bars join the spillway to the apron and to the training walls.

b. Design and Construction Data. The embankment cross-section geometry appears to be in general conformance with the design drawing cross-section. No information on stability analyses, seepage computations, or soil properties is available. According to the drawings, the embankment was not provided with a rock toe or a filter blanket. The embankment core material was defined as "the most clayey or impervious material" obtained from the borrow source. No information is available concerning construction supervision or material testing.

c. Operating Records. The owner's representative was not aware of any operating records associated with this site.

d. Post Construction Changes. No reported post construction changes are included in the information provided by DER.

e. Seismic Stability. The dam is located within Seismic Risk Zone 1 of the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any expected earthquake loading if it is safe under static loading conditions.

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, PROPOSED REMEDIAL MEASURES

#### 7.1 Dam Assessment

a. Safety. The visual observations and review of available information indicate that the Marcel Lake Dam is in poor condition. The many deficiencies and problem areas noted in Sections 6.1.a and 6.1.b. evidence a general lack of maintenance and potentially hazardous structural conditions.

The spillway is capable of discharging 40 per cent of the PMF without overtopping of the earth embankment. Failure of the dam by overtopping would increase the hazard to loss of life downstream of the dam. Therefore, the spillway is classified as "seriously inadequate", and the dam is classified as "unsafe (non-emergency)".

b. Adequacy of Information. The information provided by DER appears to be adequate for a Phase I investigation.

c. Urgency. Further investigations and recommended remedial measures should be implemented immediately.

d. Necessity for Further Investigations. Further investigations are necessary for this site. Results of the investigation should be used to establish if the materials are satisfactory for the embankment as designed and constructed; and to detect possible fines migration.

#### 7.2 Recommendations, Remedial Measures

##### a. Facilities.

1) A subsurface investigation should be initiated at several selected sections of the dam to include, but not limited to, soil borings for determination of the composition and in situ properties of the embankment and foundation materials. The investigation should be supervised by a licensed professional engineer experienced in the design and construction of dams.

2) Piezometers should be installed in the boreholes to evaluate pore pressure development throughout the embankment.

3) Areas below design elevation should have additional fill placed and compacted to regrade the embankment to design elevation immediately.

4) The depressions along the upstream face and the top of dam should be monitored to determine if any differential movement occurs.

5) The swampy area should be monitored regularly for any signs of increased seepage and/or turbid water.

6) The riprap should be supplemented with large and medium sized rock to provide a well graded riprap layer to extend to the top of dam.

- 7) Animal burrow holes should be filled with suitable earth material.
- 8) All trees and bushes should be cut at the ground level.
- 9) Detailed hydrologic and hydraulic analyses should be performed to determine the need for increasing the spillway capacity.

b. Operation and Maintenance Procedures.

- 1) The grass should be mowed regularly to prevent the growth of deep rooted vegetation, to deter burrowing animals, and to uncover other conditions potentially hazardous to the structure.
- 2) The outlet gate should be operated periodically to insure proper maintenance.
- 3) A downstream warning system should be developed, and during periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.



APPENDIX

A

Check List Engineering Data  
Design, Construction, Operation  
Phase I

NAME OF DAM Marcel Lake Dam  
ID # PA 00402

Sheet 1 of 4

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM

REMARKS

AS-BUILT DRAWINGS

There are no "As-Built" drawings. The 6 original design drawings (7/60), one revised design drawing (8/60), and one superseded design drawing (9/60) are in the DER files

REGIONAL VICINITY MAP

Refer to Appendix E, Plate 1

CONSTRUCTION HISTORY

The dam was built in 1961

TYPICAL SECTIONS OF DAM

Refer to Appendix E

OUTLETS - PLAN

DETAILS

CONSTRAINTS

DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

Refer to Appendix E

None Available

None Available



ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No data available 2 sheets in DER files (10/60) No data available No data available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	The only information available is the location of test pits on one of the drawings
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	There is no record of where the borrow material came from

ITEM	REMARKS
MONITORING SYSTEMS	<i>None</i>
MODIFICATIONS	<i>None</i>
HIGH POOL RECORDS	<i>None available</i>
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	<i>None</i>
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	<i>None</i>
MAINTENANCE OPERATION RECORDS	<i>The impoundment has been drawn down several times to clean the bottom of the lake and to improve beaches and docking facilities.</i>

ITEM	REMARKS
SPILLWAY PLAN	Refer to Appendix E
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Refer to Appendix E
MISCELLANEOUS	<p>Material in DER files:</p> <ol style="list-style-type: none"> <li>1. "Application", "Report Upon the Application", and "Permit" to construct Marcell Lake Dam 1960</li> <li>2. Drawings</li> <li>3. Contract provisions and specifications</li> <li>4. Photographs</li> <li>5. "Application for Permit to Draw Dam or Other Body of Water in Accordance with the Act of 12/15/59" (5 applications)</li> <li>6. Miscellaneous correspondence, inspection reports, etc.</li> </ol>



APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST  
VISUAL INSPECTION  
PHASE I

Sheet 1 of 11

Name Dam Albion/Lake Dam County Pike State Pennsylvania National ID # PA 00402  
Type of Dam Compacted Earth Hazard Category High  
Date(s) Inspection Nov 22, 1978 Weather Cloudy 30/d Temperature 25° to 30°F

Pool Elevation at Time of Inspection 1231.0± M.S.L. Tailwater at Time of Inspection \_\_\_\_\_ M.S.L.

Inspection Personnel:

George C. Elias

David Campbell

Robert Bowers

Leonard Beck

David Campbell

Recorder

Remarks:

A representative of the owner met us at the site.

CONCRETE/MASONRY DAMS

Sheet 2 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

ANY NOTICEABLE SEEPAGE

N/A

STRUCTURE TO  
ABUTMENT/EMBANKMENT  
JUNCTIONS

N/A

DRAINS

N/A

WATER PASSAGES

N/A

FOUNDATION

N/A



CONCRETE/MASONRY DAMS

Sheet 3 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

# EMBANKMENT

Sheet 4 of 11

## REMARKS OR RECOMMENDATIONS

## OBSERVATIONS

## VISUAL EXAMINATION OF

## SURFACE CRACKS

None observed

None

## UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE

None observed

None

## SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES

Undulating depressions were observed along the upstream face of the dam. The depressions extend from the top of the dam to beneath the water surface in some locations. The slope of the upstream face varies from 2H:1V to 4H:1V. The slope of the downstream face varies from 1.7H:1V to 2H:1V.

A boring program should be considered to determine the composition and in situ properties of the embankment and foundation materials. From this information the stability of the dam can be determined.

Piezometers should be installed in the bore holes to evaluate pore pressure development throughout the embankment.

## VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST

The top of the dam is an undulating surface. The top of the dam survey reveals that about 400 feet of the top of the dam is below design elevation (Refer to Appendix E, Plate 5).

## RIPRAP FAILURES

The riprap is small and poorly graded. There is little uniformity in the distribution and placement of the riprap.

Repair the riprap so needed to provide protection from wave action.

EMBANKMENT

Sheet 5 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed	None
---	----------------------	------

ANY NOTICEABLE SEEPAGE	There is extensive seepage from the downstream toe of the dam from the reservoir drain outlet to within 75 feet of the right abutment. The resulting swampy region extends from the dam to the highway a distance varying from 50 to 100 feet. Refer to Appendix E, Plate 4	Refer to Corps proposal submitted on 4/11
------------------------	---	--

STAFF GAGE AND RECORDER	None	None
-------------------------	------	------

DRAINS	None	None
--------	------	------



# OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed. Very little could be observed because the conduit is either under embankment or under water	Drain down the impoundment so that the reservoir-dam system can be better observed.
INTAKE STRUCTURE	What could be seen of the intake structure above the water surface appeared to be in good condition.	"
OUTLET STRUCTURE	Appeared to be in good condition	
OUTLET CHANNEL	The channel is somewhat obstructed by sediment and vegetation	clean out the channel
EMERGENCY GATE	The sluice gate could not be observed because it was under water. The sluice gate hoist was in place on top of the intake structure. The owner's representative didn't know if the sluice gate was operable	The sluice gate should be examined.

UNGATED SPILLWAY

Sheet 7 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Some minor surface spalling of concrete was noted along the training walls.	Repair the spalled concrete where necessary
APPROACH CHANNEL	The approach is in good condition with a thick cover of large riprap on both banks	
DISCHARGE CHANNEL	The discharge channel appears to be in good condition.	
BRIDGE AND PIERS	N/A	

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	



INSTRUMENTATION

Sheet 9 of 11

<u>VISUAL EXAMINATION</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
MONUMENTATION/SURVEYS	N/A	
OBSERVATION WELLS	N/A	
WEIRS	N/A	
PIEZOMETERS	N/A	
OTHER	N/A	

RESERVOIR

Sheet 10 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

The slopes vary from a maximum of about 20 percent to a minimum of about 3 percent around the perimeter of the lake.

None

SEDIMENTATION

The entire perimeter of the lake is wooded. There would be some sediment deposition in the future when additional homes are built on the lake shore.

Sediment control measures should be implemented for future construction along the lake shores.

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	<p>Dunsmuir Creek flows through the bridge for State Legislative 51006 about 300 feet downstream of the spillway. Lake Massad Dam is located about 100 feet downstream of Morrel Lake. This region is forested. Lake Massad Dam's spillway is 100 feet wide with a 5 foot freeboard. The potential hazard area began about 500 feet downstream of Lake Massad Dam where Dunsmuir's Creek parallels Rt. 51006. Several acres are located on the left bank of Dunsmuir's Creek located along both banks for the next mile.</p>	<p>An estimated "7" value for the downstream reaches except for Massad Lake is 0.05 for the stream channel.</p>
SLOPES	<p>The channel gradient is about 2 percent between the Morrel Lake Dam Spillway and Massad Lake. Between Massad Lake Dam and Nye Lake (55000) the channel gradient is about 1.5 percent.</p>	None
APPROXIMATE NO. OF HOMES AND POPULATION	<p>There are about 30 homes and several commercial establishments which would affect approximately 500 people in the area back from Morrel Lake to Nye Lake.</p>	<p>A formal warning system should be developed and implemented. Procedures for evacuating people within the potential flood area should be implemented.</p>

APPENDIX

C

Hydrologic & Hydraulic Data



SUBJECT	SHEET	BY	DATE	JOB NO.
Marcel Lake Dam				

## Table of Contents APPENDIX C

Tp Computations	Sh 1
PMP Data	Sh 1
Lake Rene' Dam Outflow Rating	Sh 2
Stage - Discharge for Marcel Lake Dam	Sh 3
Lake Massad (Swy. Characteristics, Dam Top, Res. Storage)	Sh 3A
Downstream Sections (1 & @ Hazard Area)	Sh 4
Overall Watershed Map	Sh 5
HEC-I Dam Safety Version Computer Output Without Breach of Dam	Sh 6-11
HEC-I Dam Safety Version Computer Output With Breach of Dam for 50 Percent PMF	Sh 12-23



SUBJECT	SHEET	BY	DATE	JOB NO
Marcel Lake Dam - Hydrology	1	DBC	2/15/79	1841.010

Drainage Area = 4.20 sq. mi.

Lake René subbasin = 1.53 sq. mi.

Marcel Lake subbasin = 2.67 sq. mi.

Snyder Hydrograph Coefficients (From C.O.E., Baltimore)

$$C_t = 1.23 \quad C_p = .45 \quad (\text{Zone 1})$$

### $T_p$ computations

1) Lake René Subbasin  
( $L = 2.46$  miles,  $L_{ca} = 1.14$  miles)  
 $T_p = C_t (L \cdot L_{ca})^3$

$$T_p = 1.23 \cdot (2.46 \cdot 1.14)^3 = \underline{1.68 \text{ hours}}$$

2) Marcel Lake Subbasin  
( $L = 3.03$  miles,  $L_{ca} = 1.1$  miles)

$$T_p = C_t (L \cdot L_{ca})^3$$

$$T_p = 1.23 (3.03 \cdot 1.10)^3 = \underline{1.77 \text{ hours}}$$

### PMP DATA

6 hr 200 sq. mi index rainfall = 22"

6 hr	%	of index	for this basin	= 111%
12	"	"	"	= 124%
24	"	"	"	= 133%



## Lake René Dam Outflow Rating

5' of freeboard

Spillway  $L=55'$   $C=3.3$

Top of Dam  $L=900'$   $C=3.1$

Stage (H-ft)	Outflow (Q - cfs)	Surcharge Storage (St) (acre-feet)
0	0	0
1	182	79
2	513	158
3	943	237
4	1452	316
5	2029	395
6	5457	474
7	11253	553

## Lake René Storage Rating

Assume constant <sup>reservoir</sup> area over the range of stages  
 $A = 79$  acres (planimetered along approximate boundary).  $St = 79 \cdot H$

The storage-outflow relation shall be used to route through the reservoir. The reach between Lake René Dam and Marcel Lake is short and has been neglected. (Travel time less than 5 minutes).





SUBJECT

Marcel Lake Dam - Hydrology

SHEET

3

BY

DBC

DATE

2/16/79

JOB NO

1841.010

Stage - Discharge for Marcel Lake Dam  
(H = 0 @ spillway crest)

Spillway  $C = 3.7$   $L = 60'$   $Q_s = CLH^{3/2}$

Low area @ top of dam  $C = 3.1$   $L = 300'$   
 $Q_{low} = CL(H - 5.5)^{3/2}$

Remainder of top of dam  $C = 3.1$   $L = 300'$   
 $Q_{top} = CL(H - 6.5)^{3/2}$

Elevation	H	$Q_s$	$Q_{low}$	$Q_{top}$	$\Sigma Q$
1231	0	0	0	0	0
1232	1	222	0	0	222
1233	2	628	0	0	628
1234	3	1154	0	0	1154
1235	4	1776	0	0	1776
1236	5	2482	0	0	2482
1236.5	5.5	2863	0	0	2863
1237.5	6.5	3679	930	0	4609
1238.5	7.5	4560	2630	930	8120
1239.5	8.5	5502	4832	2630	12964





SUBJECT	SHEET	BY	DATE	JOB NO.
Marcel Lake Dam Hydrology	3A	DBC	4/9/79	1841.010

## LAKE MASSAD

### Spillway Characteristics

Crest Elevation - 1175 (Pool Elevation on quad)

Length - 100 feet

Weir coefficient - 3.3

$$Q = 330 H^{1.5}$$

### Top of Dam

Crest Elevation - 1180 (five feet of freeboard)

Length - 150 feet

Weir coefficient - 3.1

$$Q = 465 H^{1.5}$$

### Reservoir Storage

Assumed storage and area to be zero @ 1170

Other areas planimetered from quad as follows:

Elev. 1175 14 acres

Elev. 1180 24 acres

Elev. 1200 50 acres

Storage calculated from conic method



O'BRIEN & GERE

SUBJECT

Marcel Lake Dam - Hydrology

SHEET

4

BY

DBC

DATE

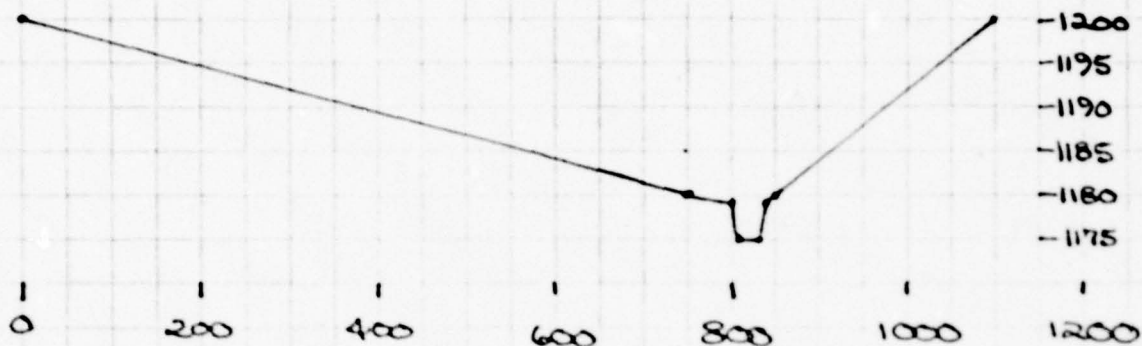
2/28/79

JOB NO

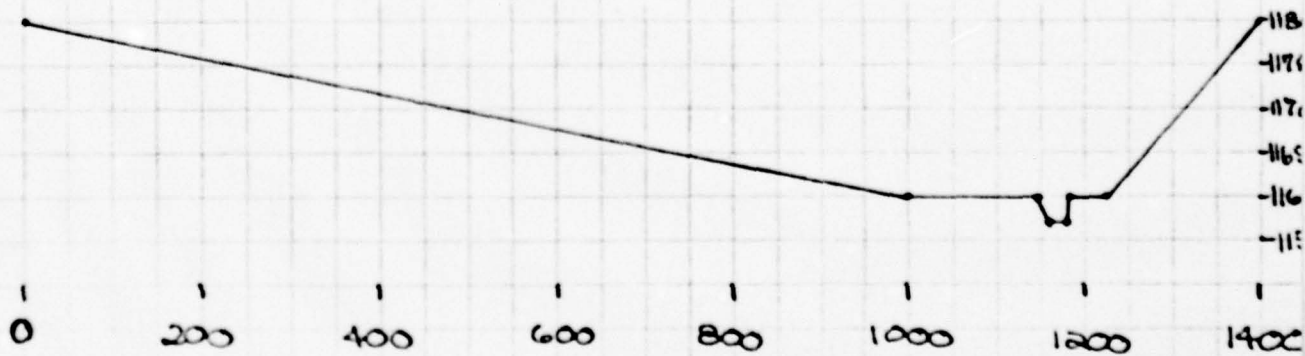
1841.010

## DOWNSTREAM ROUTING

Downstream Section - 1 (D/S-1)



Downstream Section @ Hazard Area (HAZARD)









.....  
 FLOOD HYDROGRAPH PACKAGE (REC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 25 SEP 78  
 .....

RUN DATE 03/14/79.  
 TIME 13.16.39.

247

HYDROLOGIC ANALYSIS OF MARCEL LAKE DAM  
 NATIONAL DAM SAFETY PROGRAM  
 BALTIMORE DISTRICT CORPS OF ENGINEERS

JOB SPECIFICATION									
NQ	NHR	NMIN	ISAY	IMH	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0
JOPEP 5									
NPT LROPT TRACE 0									

MULTI-PLAN ANALYSES TO BE PERFORMED  
 NPLAN= 1 NATION V LATION= 1

RTIOS	.20	.30	.40	.50	.60	.70	.80	.90	1.00

.....

SUB-AREA RUNOFF COMPUTATION

INFLOW TO LAKE RENE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRY	INAME	ISTAGE	IAUTO
RENE-1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA									
INPDC	IUMG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISHOW	ISAME	LOCAL
1	1	1.53	0.00	0.00	0.00	0.000	0	1	0

PRECIP DATA									
SPFE	PMS	RA	P12	RA4	RT2	RYA			
0.00	22.00	111.00	124.00	133.00	0.00	0.00			

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA										
LROPT	STBR	OLTR	RTIOL	CRAIN	STRES	RTIOW	STRTL	CNSTL	ALSMR	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA  
 TP= 1.00 CP= .45 NFA= 0

RECESSION DATA  
 STRTO= -1.50 QUCSN= -.05 RTIOW= 2.00

UNIT HYDROGRAPH 31 END-OF-PERIOD ORIGINATES. LAG= 1.00 HOURS. CP= .45 VOL= 1.00									
36.	130.	226.	255.	285.	187.	155.	129.	107.	89.
74.	61.	51.	42.	35.	29.	24.	20.	17.	14.
12.	10.	8.	7.	5.	5.	4.	3.	3.	2.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP
END-OF-PERIOD FLOW													
SUM 23.41 21.56 1.05 66057.													
( 595.11 546.11 47.11 1247.56)													

.....



# COMBINE HYDROGRAPHS

## COMBINE HYDROGRAPHS

ISTAG ICOMP IECON ITAPE IJLT JPRT INAME ISTAGE IAUTO  
TOTAL 2 0 0 0 0 0 0 0 0

249

.....

## HYDROGRAPH ROUTING

### ROUTED OUTFLOW FROM MARCEL LAKE

ISTAG ICOMP IECON ITAPE IJLT JPRT INAME ISTAGE IAUTO  
MARCEL-0 1 0 0 0 0 0 0 0

ROUTING DATA  
WLOSS CLOSS AVG IRES ISAME IOPT IPWP LSTW  
0.0 0.000 0.00 1 1 0 0 0

NSTPS NSTOL LAG AMSKS X TSK STORA ISPRAT  
0 0 0 0.000 0.000 0.000 -1231. -1

STAGE 1231.00 1232.00 1233.00 1234.00 1235.00 1236.00 1237.50 1238.50 1239.50  
FLOW 0.00 222.00 628.00 1154.00 1776.00 2482.00 4809.00 8120.00 12966.00

SURFACE AREA 0. 27. 37. 78.  
CAPACITY 0. 169. 440. 1567.  
ELEVATION 1215. 1231. 1245. 1260.

CHREL SPED COG EXPW ELEV COOL CAREA EXPL  
1231.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA  
TOBEL COG EXPW DAMWID  
1236.5 0.0 0.0 0.

PEAK OUTFLOW IS 1370. AT TIME 19.00 HOURS  
PEAK OUTFLOW IS 2120. AT TIME 19.00 HOURS  
PEAK OUTFLOW IS 2912. AT TIME 18.50 HOURS  
PEAK OUTFLOW IS 3753. AT TIME 18.50 HOURS  
PEAK OUTFLOW IS 4551. AT TIME 18.50 HOURS  
PEAK OUTFLOW IS 5392. AT TIME 18.00 HOURS  
PEAK OUTFLOW IS 6176. AT TIME 18.50 HOURS  
PEAK OUTFLOW IS 7371. AT TIME 18.50 HOURS  
ITERATIVE SOLUTION DID NOT CONVERGE 36 1 0.000 1.234E+03 4.232E+02 1.238E+03 -6.366E+02  
PEAK OUTFLOW IS 8882. AT TIME 18.50 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUMIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

M 10

OPERATION	STATION	AREA	PLAN	RATIO	RATIOS APPLIED TO FLOWS								
					1	2	3	4	5	6	7	8	9
					.20	.30	.40	.50	.60	.70	.80	.90	1.00
HYDROGRAPH AT WENE-I	(	1.53	1	942.	993.	1324.	1655.	1996.	2317.	2648.	2979.	3310.	
		( 3.96)	(	( 18.74)	( 28.11)	( 37.49)	( 46.86)	( 56.23)	( 65.60)	( 74.97)	( 84.34)	( 93.72)	
ROUTED TO WENE-O	(	1.53	1	421.	683.	947.	1229.	1504.	1790.	2194.	2770.	3182.	
		( 3.96)	(	( 11.93)	( 19.34)	( 26.81)	( 34.79)	( 42.58)	( 50.76)	( 62.12)	( 78.45)	( 96.69)	
HYDROGRAPH AT WRC-L-I	(	2.67	1	1119.	1679.	2239.	2796.	3358.	3918.	4478.	5037.	5597.	
		( 6.92)	(	( 31.70)	( 47.55)	( 63.40)	( 79.25)	( 95.10)	( 110.95)	( 126.79)	( 142.64)	( 158.49)	
2 COMBINED TOTAL	(	4.20	1	1420.	2179.	2976.	3770.	4580.	5392.	6215.	7026.	7871.	
		( 10.88)	(	( 40.21)	( 61.71)	( 84.26)	( 106.76)	( 129.70)	( 152.86)	( 175.98)	( 210.29)	( 245.54)	
ROUTED TO WRC-L-O	(	4.20	1	1376.	2120.	2912.	3753.	4551.	5392.	6176.	7371.	8882.	
		( 10.88)	(	( 39.78)	( 60.02)	( 82.46)	( 104.29)	( 128.86)	( 152.87)	( 174.88)	( 208.71)	( 251.52)	



# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

ELEVATION  
STORAGE  
OUTFLOW

INITIAL VALUE  
1231.10  
163.  
22.

SPILLWAY CHEST  
1231.00  
160.  
0.

TOP OF DAM  
1236.50  
324.  
2863.

Sh 11

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1234.35	0.00	256.	1375.	9.00	19.00	0.00
.30	1235.49	0.00	242.	2125.	0.00	19.00	0.00
.40	1236.53	.03	325.	2912.	1.00	18.50	0.00
.50	1237.01	.51	341.	3753.	3.00	18.50	0.00
.60	1237.47	.97	356.	4551.	4.50	18.50	0.00
.70	1237.72	1.22	365.	5342.	5.50	18.00	0.00
.80	1237.95	1.45	373.	6176.	6.00	18.50	0.00
.90	1238.29	1.79	384.	7371.	7.00	18.50	0.00
1.00	1238.52	2.02	393.	8862.	7.00	18.50	0.00



0.5PMF with Don Beach PH 13

[illegible]

.....  
 FLOOD HYDROGRAPH PACKAGE (FEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 25 SEP 78  
 .....

RUN DATE 03/16/79  
 TIME 08.14.52.

0.5 PMF with Dam Break Sh 14

HYDROLOGIC ANALYSIS OF MARCEL LAKE DAM  
 NATIONAL DAM SAFETY PROGRAM  
 BALTIMORE DISTRICT COMPS OF ENGINEERS

JOB SPECIFICATION									
NO	NHR	NMIN	IDAY	IMR	IMIN	METPC	IPLT	IPRT	NSTAN
100	0	30	0	0	0	0	0	-4	0
JOPER NWT LROPT TRACE									
5 0 0 0									

MULTI-PLAN ANALYSES TO BE PERFORMED  
 NPLAN= 2 NRATIO= 1 LPTIO= 1

RTIO= .50

.....

SUB-AREA RUNOFF COMPUTATION

INFLOW TO LAKE RENE

ISTAD	ICOMP	ISECON	ITAPE	JPLT	JPRY	INAME	ISTAGE	IAUTO
RENE-1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA									
INYD	IUNG	TAREA	SNAP	TRSSA	TRSEC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.53	0.00	4.20	0.00	0.000	0	1	0

PRECIP DATA

SPEE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .000

LOSS DATA

LROPT	STKR	OLTR	RTIO	CHAIN	STKS	RTIO	STPL	CNSTL	ALSM	RTMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.68 CPE .45 NTA= 0

RECESSION DATA

STRIO= -1.50 QRCSE= -.05 RTIO= 2.00

UNIT HYDROGRAPH 31 END-OF-PERIOD ORIGINATES, LAG= 1.54 HOURS, CPE .45 VOL= 1.00									
36.	140.	226.	255.	225.	187.	155.	129.	107.	89.
74.	91.	51.	42.	35.	29.	24.	20.	17.	14.
12.	10.	8.	7.	5.	5.	4.	3.	3.	2.
2.									

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
SUM 23.41 21.56 1.05 44057.													
( 595.11 548.11 67.11 1247.56)													

.....



0.5 PMF with Dam Break Ph 15

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM LAKE RENE

ISTAG	ICOMP	TECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
RENE-0	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME

ROUTING DATA

LOSS	CLOSS	AVG	IRIS	ISAME	IOPT	ISMP	LSTR
0.0	0.000	0.00	1	1	0	0	0
NSTPS	NSTOL	LAG	AMSKA	X	TSK	STORA	ISPRAT
0	0	0	0.000	0.000	0.000	-1.	0
STORAGE	0.00	158.00	237.00	316.00	345.00	474.00	553.00
OUTFLOW	0.00	182.00	943.00	1452.00	2029.00	5457.00	11253.00

\*\*\*\*\*

SUB-AREA RUNOFF COMPUTATION

INFLOW TO MARCEL LAKE LESS LAKE RENE OUTFLOW

ISTAG	ICOMP	TECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
WACL-1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

INTDQ	IUMS	TAREA	SNAP	THSDA	THSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.67	0.00	4.22	0.00	0.000	0	1	0

PRECIP DATA

SPCE	QWS	RA	R12	R24	R48	R72	R96
0.00	22.00	111.00	124.00	133.00	0.00	0.00	0.00

THSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LOOPT	STARR	OUTER	RTIOL	GRAIN	STAKS	RTIOW	STRTL	CNSTL	ALSHL	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TPA	1.77	CPE	.45	NTRA	0
-----	------	-----	-----	------	---

RECESSION DATA

STRTON	-1.50	QACSNR	-.05	RTIOWR	2.00
--------	-------	--------	------	--------	------

UNIT HYDROGRAPH 33 END-OF-PERIOD COORDINATES. LAG= 1.77 HOURS. CPE= .45 VOL% 1.00

ST.	209.	368.	425.	383.	321.	270.	224.	190.	160.
134.	94.	79.	67.	56.	47.	39.	33.	28.	24.
23.	16.	14.	12.	10.	8.	7.	6.	5.	4.
0.	3.	3.	3.	3.	3.	3.	3.	3.	3.

MO.DA HM.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HM.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 23.41 21.56 1.85 76724.

1 545.11 548.11 47.11 2172.581

\*\*\*\*\*

0.5 PMF with Dam Breach Sh 16

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

ISTAG ICOMP RECON IFAPE JPLT JPRT INAME ISTAGE IAUTO  
TOTAL 2 0 0 0 0 0 0 0

.....

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM MARCEL LAKE

ISTAG ICOMP RECON IFAPE JPLT JPRT INAME ISTAGE IAUTO  
MARCEL-0 1 0 0 0 0 0 0

ALL PLANS HAVE SAME

WLOSS LOSS AVG IRES ISAME IOPT IPMP LSTR  
0.0 0.000 0.00 1 1 0 0  
NSTPS NSTOL LAG AMSKK Z TSM STORA ISPRAT  
0 0 0 0.000 0.000 0.000 -1231. -1

STAGE 1231.00 1232.00 1233.00 1234.00 1235.00 1236.00 1237.50 1238.50 1239.50  
FLOW 0.00 222.00 626.00 1154.00 1776.00 2482.00 4609.00 8125.00 12964.00

SURFACE AREA\* 0. 27. 37. 78.

CAPACITY\* 0. 168. 446. 1567.

ELEVATION\* 1215. 1231. 1240. 1260.

CREL SPWID COOL EXPW ELEV L COOL CAREA EXPL  
1231.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA  
TOPEL COOL EXPD DAMWID  
1236.5 0.0 0.0 0.

DAM BREACH DATA  
Z ELBWM TRAIL WSEL FAILED  
1.00 1223.00 2.00 1231.10 1236.80

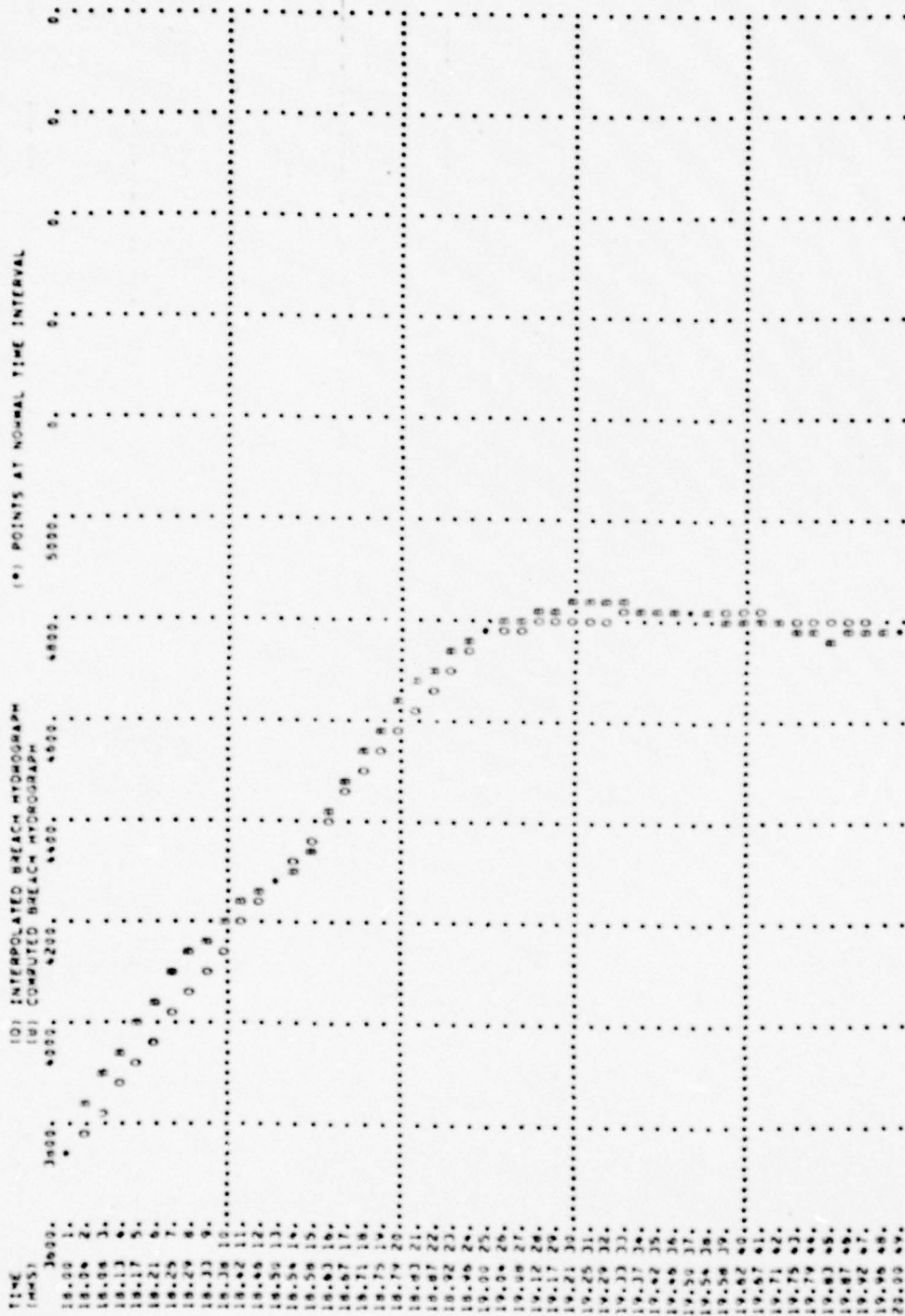
PEAK OUTFLOW IS 3753. AT TIME 18.50 HOURS

BEGIN DAM FAILURE AT 18.00 HOURS

PEAK OUTFLOW IS 4839. AT TIME 19.25 HOURS

0.5 PMF with Dam Breach Sh 17

STATION MCL-0



0.5MPS WITH DAM BREACH SK 18

.....

.....

.....

.....

.....

HYDROGRAPH ROUTING

CHANNEL ROUTING FROM MARCEL LAKE TO LAKE MASSAD

ISTAD	ICOMP	IECON	ITAPE	JPLT	JPRI	INAME	ISTAGE	IAUTO
D/S-1	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME

ROUTING DATA

QLOSS	CLOSS	AVG	IMES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAD	AMSK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QNI1	QNI2	QNI3	ELNVT	ELMAR	RLNTH	SEL
0.000	0.000	0.000	1175.0	1200.0	0.000	0.1100

CROSS SECTION COORDINATES--STA.ELEV+STA.ELEV--ETC

STA	ELEV	STA	ELEV
0+00	1200.00	750+00	1180.00
0+00	1179.00	800+00	1179.00
835+00	1179.00	850+00	1180.00
		1100+00	1200.00

STORAGE	0+00	3+22	6+84	10+85	19+79	37+44	63+04	96+58	130+07	187.52
	244.91	310.25	383.54	464.78	553.97	651.11	756.19	869.23	990.21	1110.15

OUTFLOW	0+00	123+75	396+83	791+81	1442+02	2538+83	4225+22	6630+11	9870+58	14055+32
	19286.67	25661.95	33274.31	42213.42	52565.91	64615.78	77844.70	92932.21	109756.00	126391.99

STAGE	1175+00	1176+32	1177+63	1178+95	1180+26	1181+58	1182+89	1184+21	1185+53	1186+84
	1188.16	1189.47	1190.79	1192.11	1193.42	1194.74	1196.05	1197.37	1198.68	1200.00

FLOW	0+00	123+75	396+83	791+81	1442+02	2538+83	4225+22	6630+11	9870+58	14055+32
	19286.67	25661.95	33274.31	42213.42	52565.91	64615.78	77844.70	92932.21	109756.00	126391.99

MAXIMUM STAGE IS 1182.5

MAXIMUM STAGE IS 1183.2



# 0.5 PMF with Dam Breach Sh 19

## HYDROGRAPH ROUTING

### RESERVOIR ROUTING THROUGH LAKE MASSAD

ISTAG	ICOMP	SECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
MASSAD	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

WLOSS	CLOSS	AVG	IRFS	ISAME	IOPT	IPMP	LSTM
0.0	0.000	0.00	1	1	0	0	0
NSTPS	NSTOL	LAG	AMSKN	X	TSK	STORA	ISPHAT
1	0	0	0.000	0.000	0.000	-1175.	0

SURFACE AREA\*

0. 14. 20. 50.

CAPACITY\*

0. 23. 117. 841.

ELEVATION\*

1170. 1175. 1180. 1200.

CHSL	SPWID	COOR	EXPS	ELEVL	COQL	CAREA	EXPL
1175.0	100.0	3.3	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPO	DAMWID
1180.0	3.1	1.5	150.

PEAK OUTFLOW IS 3727. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 4424. AT TIME 23.00 HOURS

.....

## HYDROGRAPH ROUTING

### CHANNEL ROUTING TO HAZARD CENTER

ISTAG	ICOMP	SECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAZARD	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

WLOSS	CLOSS	AVG	IRFS	ISAME	IOPT	IPMP	LSTM
0.0	0.000	0.00	1	1	0	0	0
NSTPS	NSTOL	LAG	AMSKN	X	TSK	STORA	ISPHAT
1	0	0	0.000	0.000	0.000	0.	0

.....

# NORMAL DEPTH CHANNEL ROUTING

QNI17 QNI21 QNI31 ELNVT ELNAR RLNTH SEL  
 .0700 .0000 .0000 1157.0 1160.0 000. 00000

0.5 PMF with Dam Break 94 80

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC  
 0.00 1169.00 1000.00 1160.00 1152.00 1140.00 1155.00 1157.00 1160.00 1157.00  
 1185.00 1160.00 1225.00 1160.00 1420.00 1420.00 1180.00

STORAGE	0.00	0.00	1.29	11.10	19.29	29.07	40.44	53.38	67.90
	00.00	101.69	120.96	166.23	189.24	213.83	241.50	269.76	300.09
OUTFLOW	0.00	116.18	377.09	2439.84	4782.23	8035.00	12271.20	17568.28	24003.87
	31654.49	40595.13	50899.15	62638.24	75882.78	107161.44	125329.14	145269.40	167846.02
STAGE	1157.00	1158.21	1159.42	1161.84	1163.05	1164.26	1165.47	1166.68	1167.89
	1169.11	1170.32	1171.53	1173.95	1175.16	1176.37	1177.58	1178.79	1180.00
FLOW	0.00	116.18	377.09	2439.84	4782.23	8035.00	12271.20	17568.28	24003.87
	31654.49	40595.13	50899.15	62638.24	75882.78	107161.44	125329.14	145269.40	167846.02

MAXIMUM STAGE IS 1167.5

MAXIMUM STAGE IS 1163.1

*0.5 PMF with Dam Break 8/1/81*

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUMIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1	.50
HYDROGRAPH AT HENE-I		1.53 (3.95)	1	1955.	
			2	(49.86)	(1955.)
ROUTED TO HENE-O		1.53 (3.95)	1	1229.	
			2	(34.79)	(1229.)
HYDROGRAPH AT MRCL-I		2.67 (6.92)	1	2799.	
			2	(79.25)	(2799.)
2 COMBINED TOTAL		4.20 (10.88)	1	3770.	
			2	(105.76)	(3770.)
ROUTED TO MRCL-O		4.20 (10.88)	1	3753.	
			2	(105.29)	(3753.)
ROUTED TO O/S-I		4.20 (10.88)	1	3761.	
			2	(105.50)	(3761.)
ROUTED TO MASSAD		4.20 (10.88)	1	3727.	
			2	(105.55)	(3727.)
ROUTED TO MAZARD		4.20 (10.88)	1	3735.	
			2	(105.77)	(3735.)

## MARCEL LANGE DAM

PLAN

ELEVATION  
STORAGE  
OUTFLOW

PLAN ! .....

PLAN ! .....

ELEVATION  
STORAGE  
OUTFLOW

ELEVATION  
STORAGE  
OUTFLOW

INITIAL VALUE
1231.10
163.
22.

SPILLWAY CREST  
1231.00  
160.  
0.

OF DAM  
1236.50  
326.  
2863.

05.  
PMF  
OF  
01110

1237.01  
A773.S.4  
R1063374  
W1141374

MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT
51	361

MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS
3753.	3.00

TIME OF  
FAILURE  
HOURS

0.00

PLAN 2 .....

ELEVATION  
STORAGE  
OUPFLON

SPILLWAY GUEST  
1231.00  
100.  
0.

P. OF CAM  
1236.50  
326.  
2863.

Ratio of PMS .50

66-9621  
A373-S-A  
BIOHSS3M  
MINI-VH

MAXIMUM DEPTH OVER OAR	MAXIMUM STORAGE AC-FY
0.00	300.

MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS
6839.	1.56

TIME OF FAILURE HOURS	
10.00	

PLAN : STATION 0/5-1

DAY	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
1	3761.0	1102.5	10.50

PLAN 2 STATION 0/5-1

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.50	4839.	1103.2	19.50



0.5 PMF with Dam Breach Sh 23

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 LAKE MASSAD DAM

ELEVATION  
STORAGE  
OUTFLOW

RATIO  
OF  
PMF

.50

MAXIMUM  
RESERVOIR  
W.S.ELEV

1180.03

MAXIMUM  
DEPTH  
OVER DAM

.03

MAXIMUM  
STORAGE  
AC-FT

118.

MAXIMUM  
OUTFLOW  
CFS

3727.

DURATION  
OVER TOP  
HOURS

.50

TIME OF  
MAX OUTFLOW  
HOURS

19.00

TIME OF  
FAILURE  
HOURS

0.00

TOP OF DAM

1180.00

117.

3690.

SPILLWAY CREST

1175.00

23.

0.

INITIAL VALUE

1175.10

25.

10.

PLAN 2

ELEVATION  
STORAGE  
OUTFLOW

RATIO  
OF  
PMF

.50

MAXIMUM  
RESERVOIR  
W.S.ELEV

1180.73

MAXIMUM  
DEPTH  
OVER DAM

.73

MAXIMUM  
STORAGE  
AC-FT

135.

MAXIMUM  
OUTFLOW  
CFS

4824.

DURATION  
OVER TOP  
HOURS

2.50

TIME OF  
MAX OUTFLOW  
HOURS

20.00

TIME OF  
FAILURE  
HOURS

0.00

TOP OF DAM

1180.00

117.

3690.

SPILLWAY CREST

1175.00

23.

0.

INITIAL VALUE

1175.10

25.

10.

PLAN 1 STATION HAZARD

RATIO

.50

MAXIMUM  
FLOW, CFS

3735.

MAXIMUM  
STAGE, FT

1182.5

TIME

19.00

PLAN 2 STATION HAZARD

RATIO

.50

MAXIMUM  
FLOW, CFS

4833.

MAXIMUM  
STAGE, FT

1183.1

TIME

20.00

APPENDIX

D

Photographs



*SPILLWAY FROM LEFT ABUTMENT*



*SPILLWAY OUTLET CHANNEL*

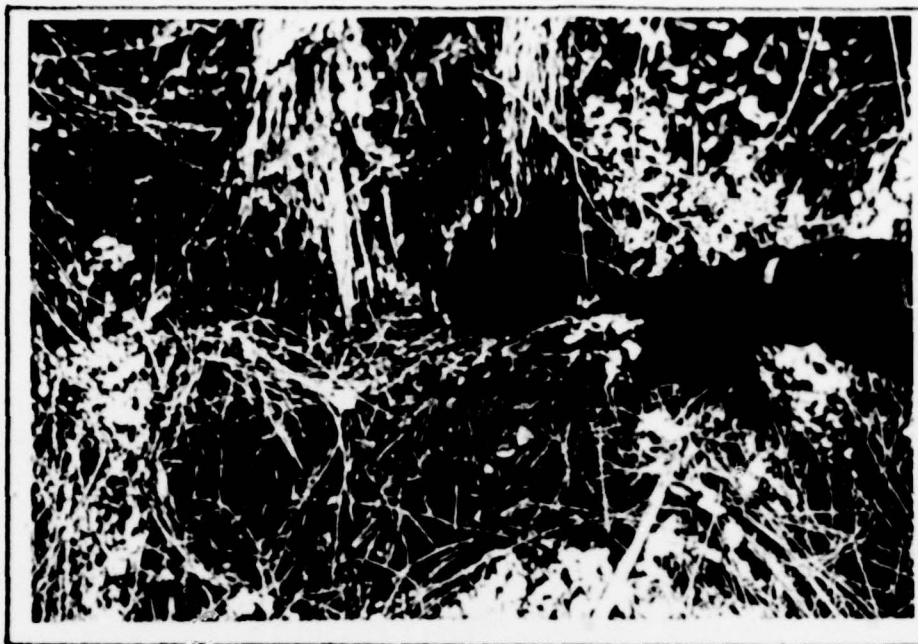


*SEEPAGE AREA DOWNSTREAM OF TOE OF DAM*



*STANDING WATER DOWNSTREAM OF TOE OF THE DAM*

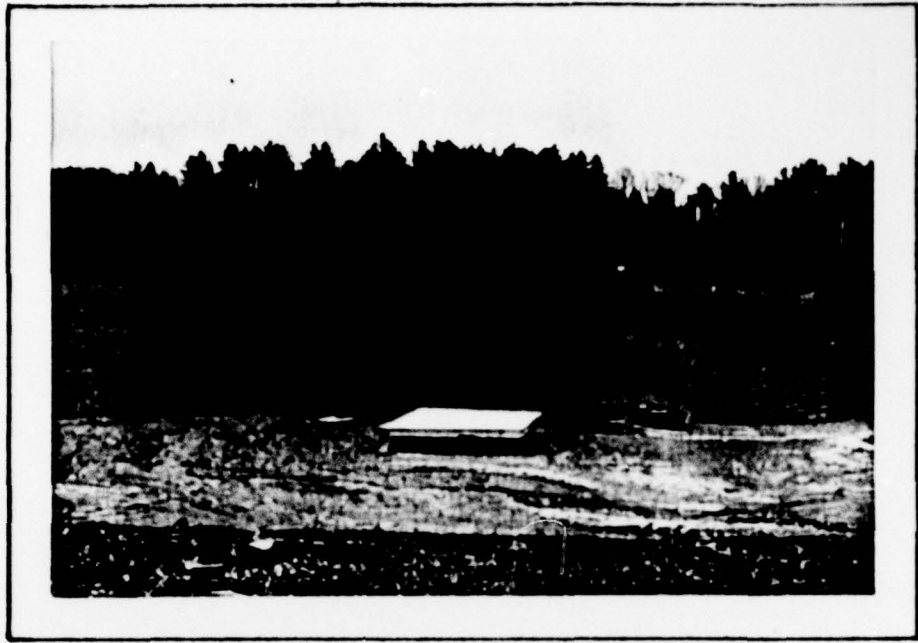




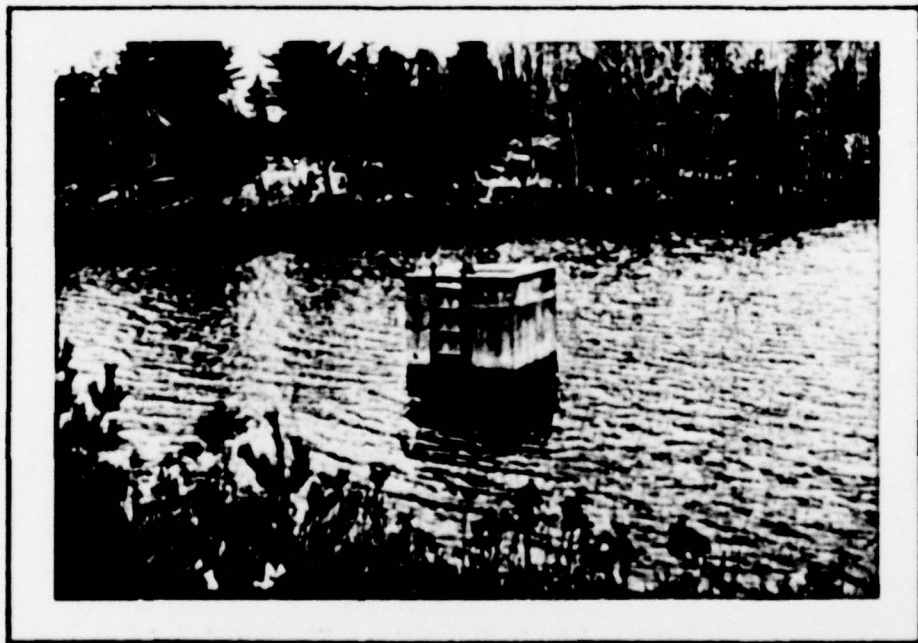
*ANIMAL BURROW HOLE ON THE DOWNSTREAM  
SLOPE OF THE DAM*



*UPSTREAM SLOPE OF THE DAM SHOWING  
RIPRAP AND VEGETATION*



*OVERVIEW OF THE UPSTREAM FACE  
OF THE DAM*



*RESERVOIR DRAIN SYSTEM  
SLUICE GATE TOWER*

APPENDIX

E

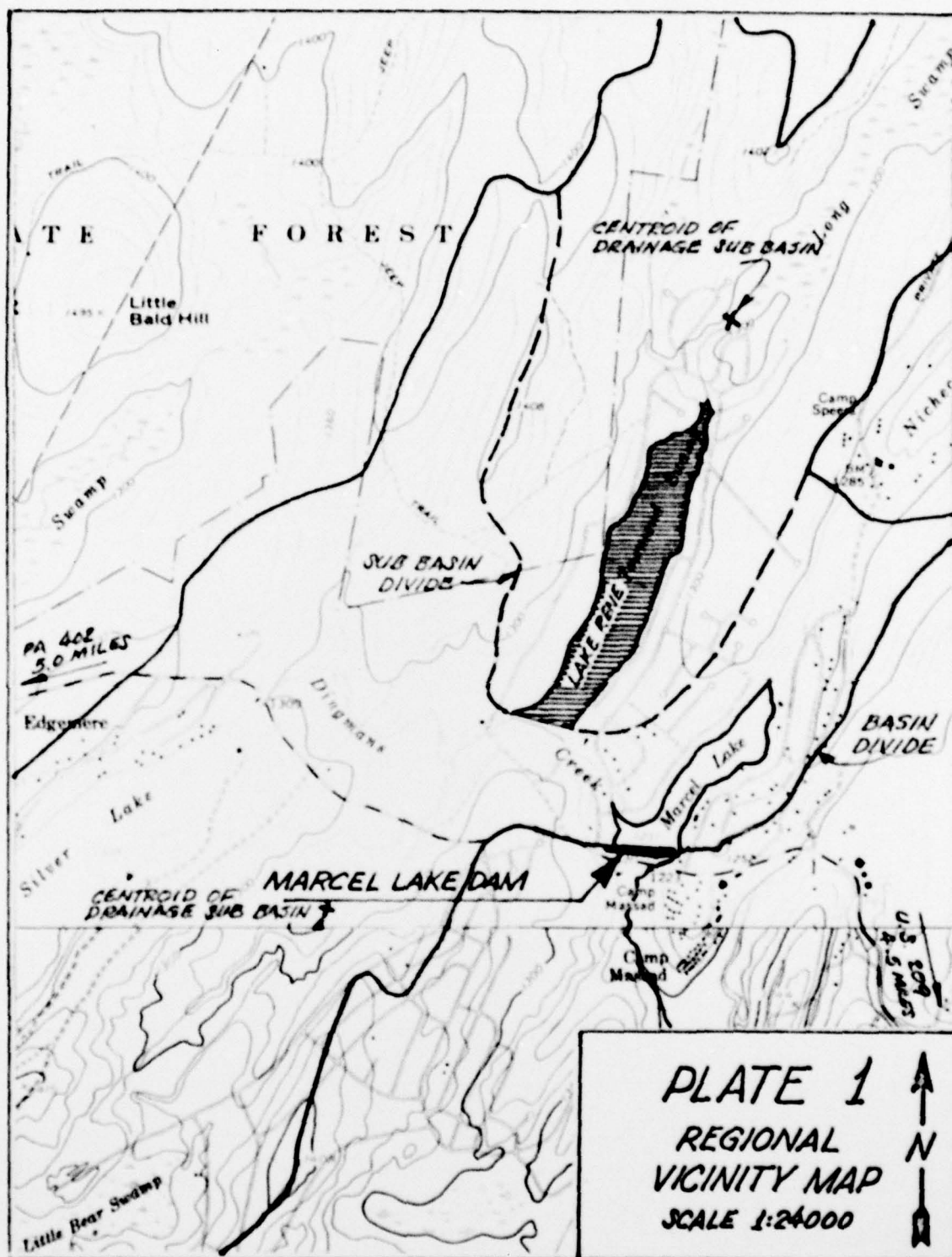
Drawings

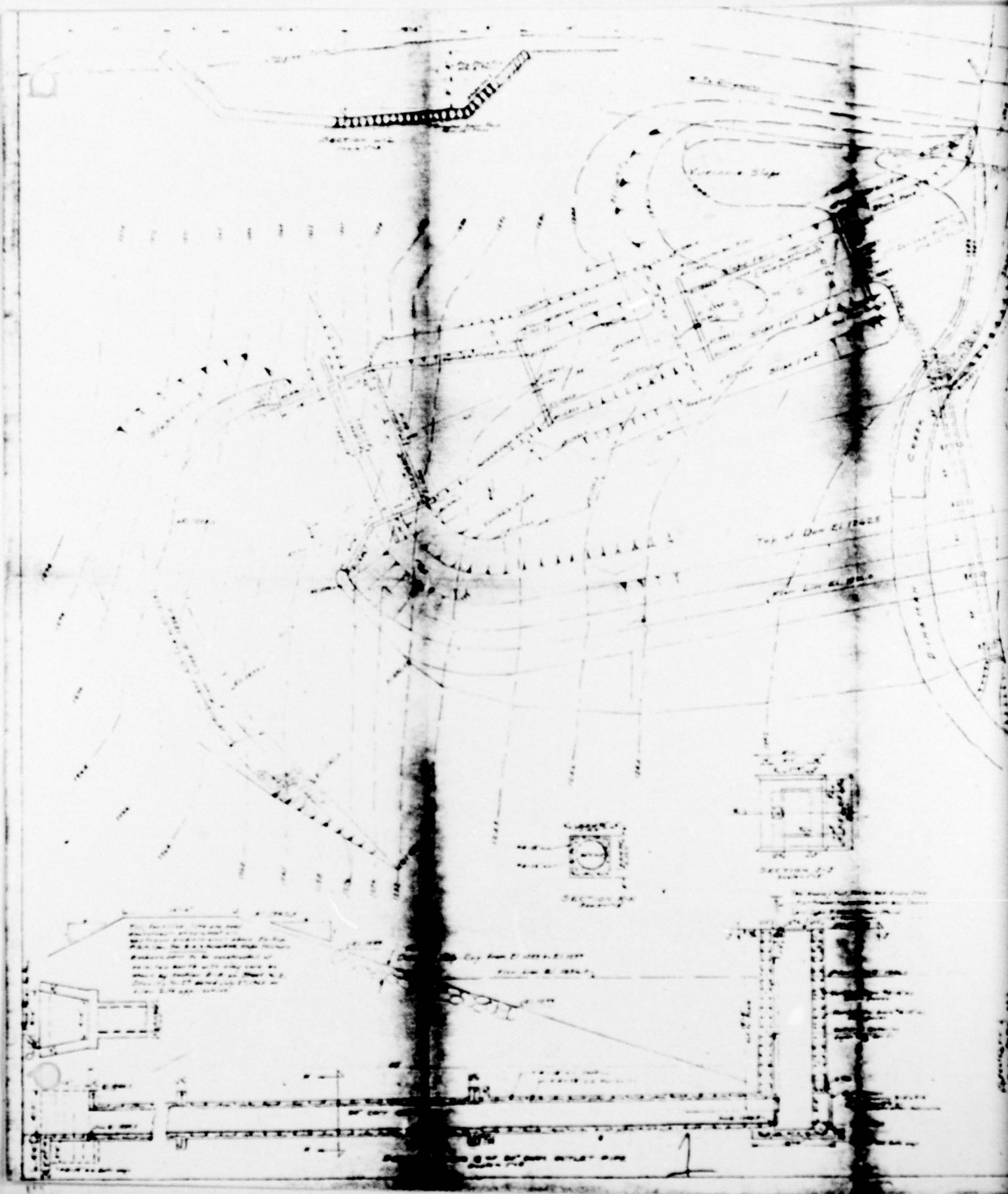
SUBJECT	SHEET	BY	DATE	JOB NO.
Marcel Lake Dam				

Table of Contents APPENDIX E

Regional Vicinity Map	Plate 1
Revised Plan of Spillway & Wastewater Channel	Plate 2
Spillway Section & Details	Plate 3
Plan View of Dam Showing Problem Areas	Plate 4
Profile of Top of Dam	Plate 5
Typical Cross Section Thru Dam	Plate 6





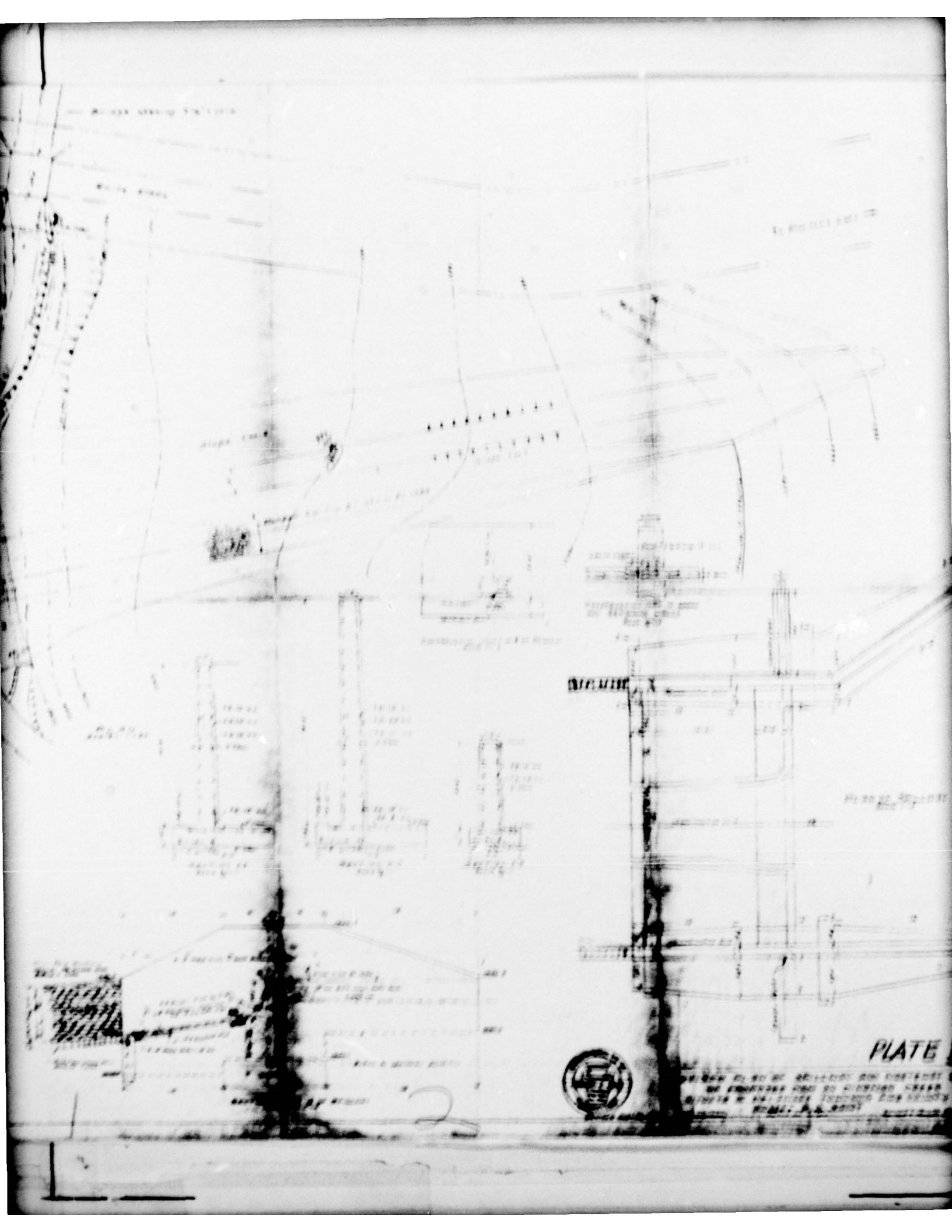


The following are the names of the various parts of the fortification:  
1. The main body of the fortification.  
2. The bastion on the right.  
3. The bastion on the left.  
4. The bastion on the top.  
5. The bastion on the bottom.  
6. The bastion on the front.  
7. The bastion on the back.  
8. The bastion on the side.  
9. The bastion on the corner.  
10. The bastion on the center.

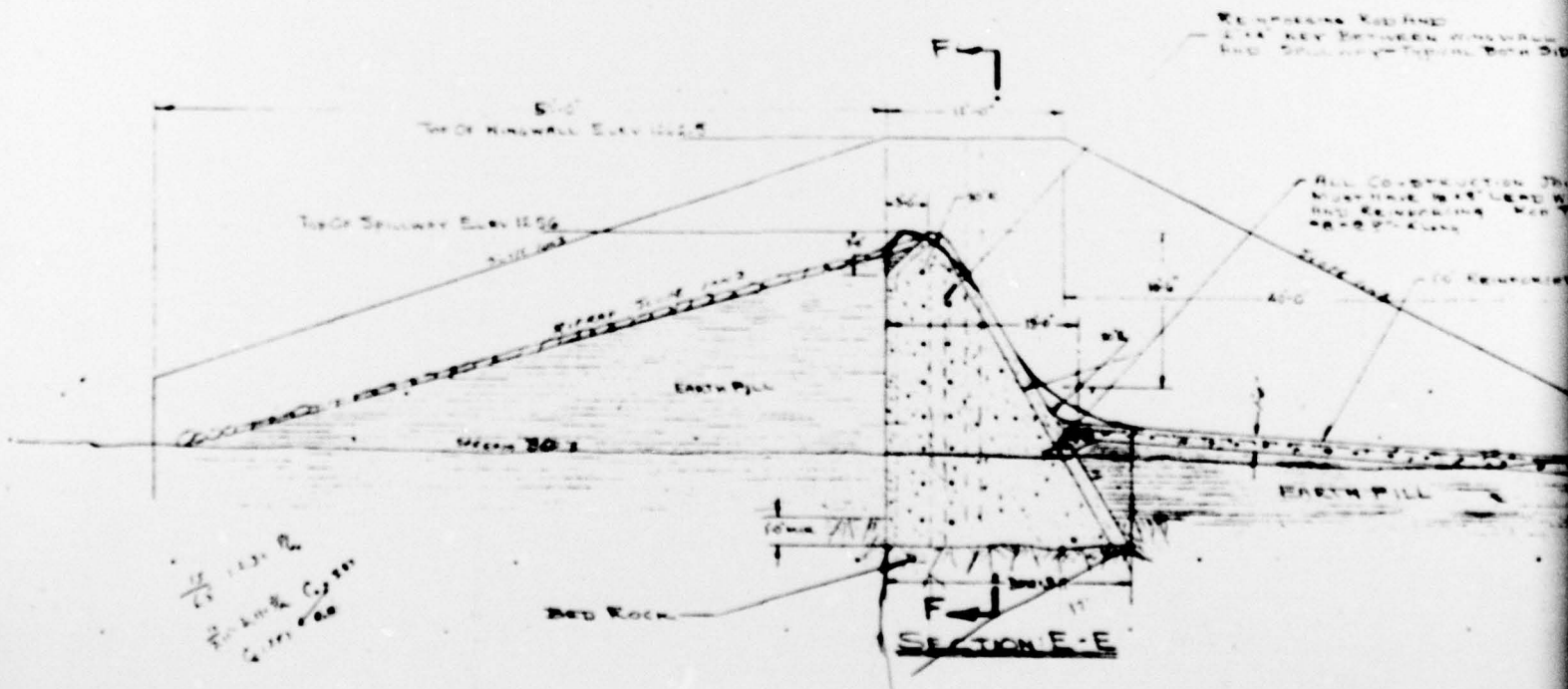
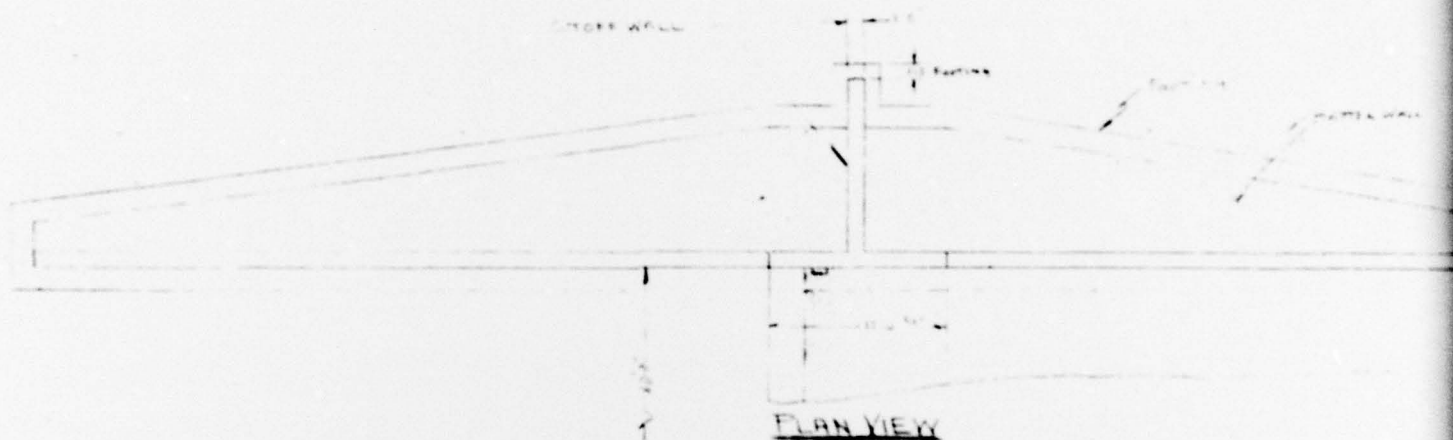
Cap. Gen. E. 1864. E. 1864.

SECTION 2

The following are the names of the various parts of the fortification:







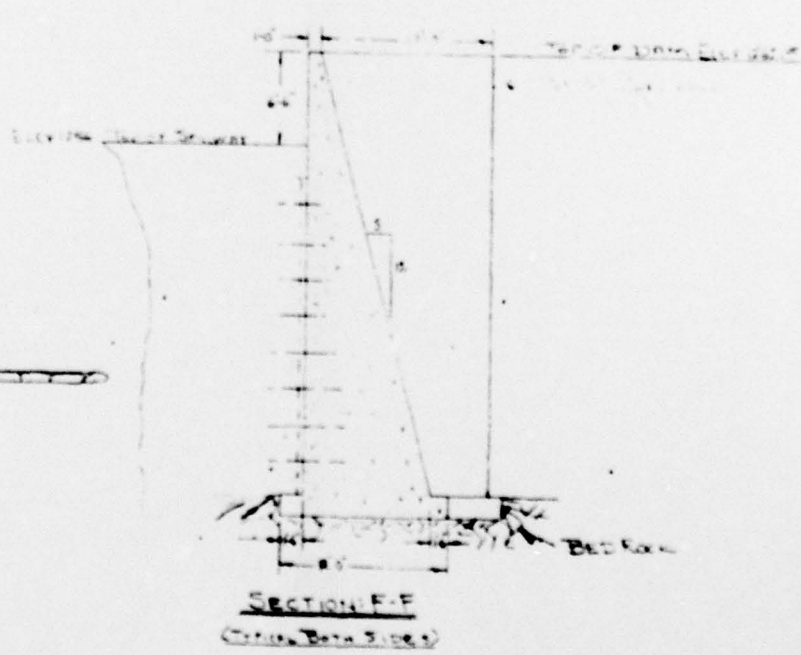
1/2 1/2 2  
 1/2 1/2 2  
 1/2 1/2 2

Drawn By: [Signature]  
 Checked By: [Signature]

1



DRAINAGE CAPACITY  
 BOTH SIDES  
 SECTION F-F  
 LEAD WATER TOWNS  
 MICHIGAN  
 IMPROVED CONCRETE DRAIN  
 DRAIN

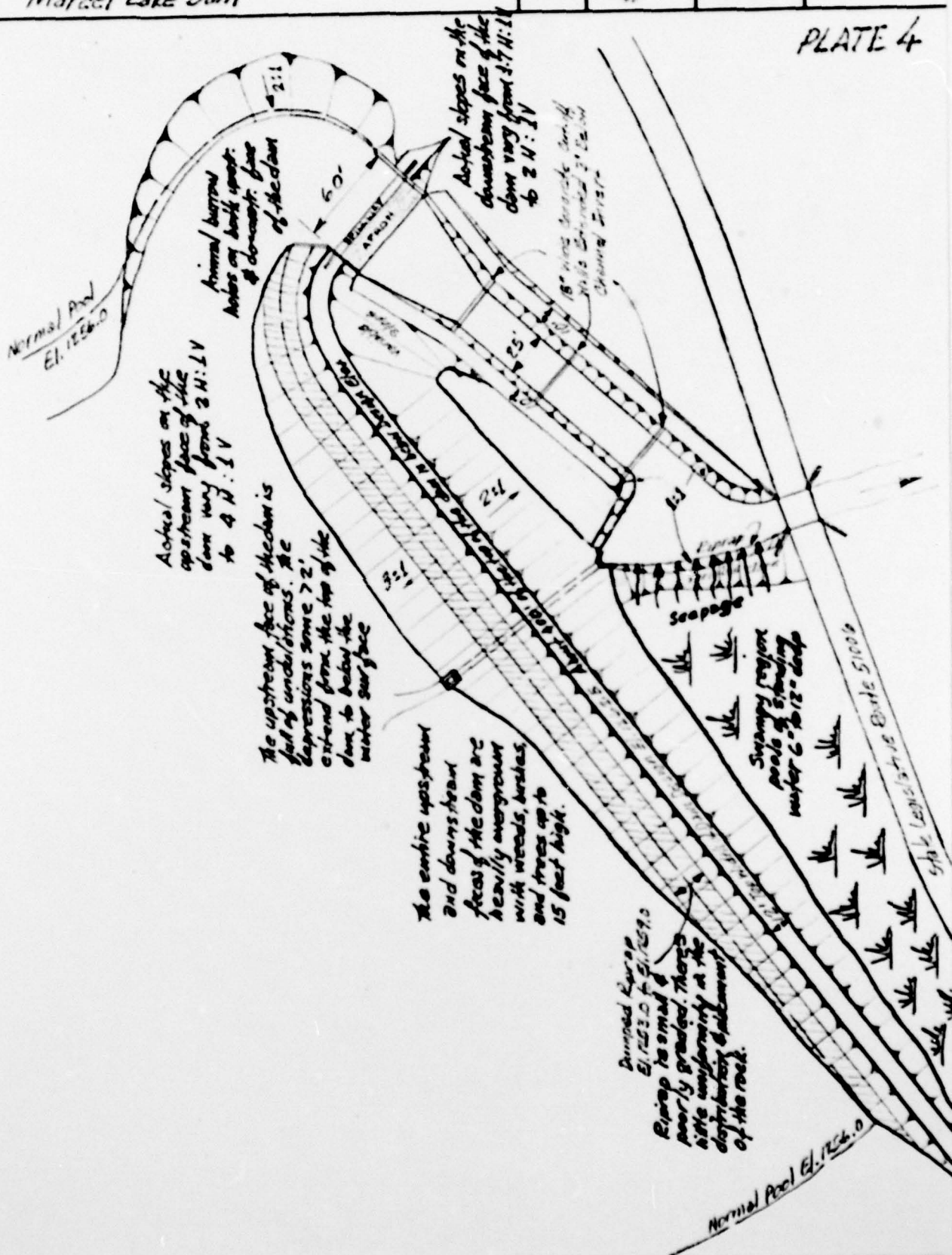


# PLATE 3

PROPOSED DAM	
MADE SAINT DELAWARE TOWNSHIP	
SPILLWAY	
SECTIONS & DETAILS	
JOHN B. FASTERSTEIN & SONS	
KETHAWOOD, PA.	
SCALE 1" = 5'-0"	DATE 11.19.20
DWG NO 27	SHEET 3

3/16/77

PLATE 4





O'BRIEN & GERE

SUBJECT

Marcel Lake Dam

SHEET

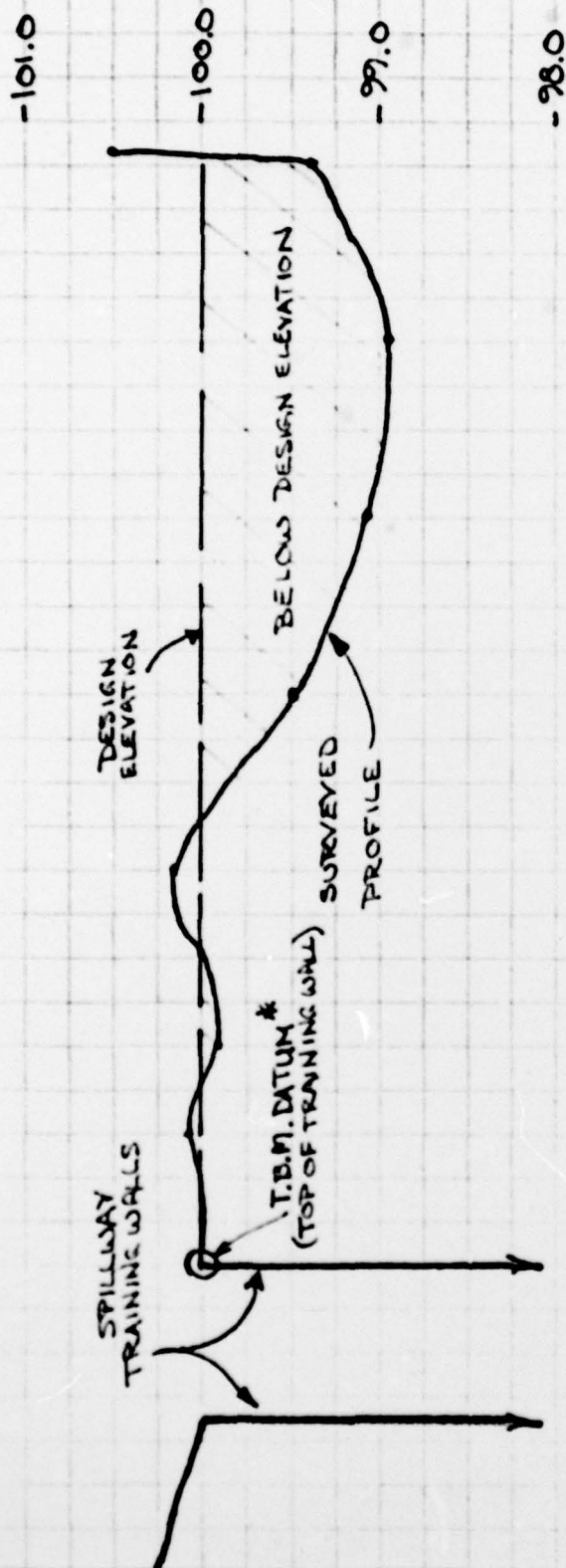
BY

DEC

DATE

3/6/79

JOB NO.



EL. 93.6 SPILLWAY CREST

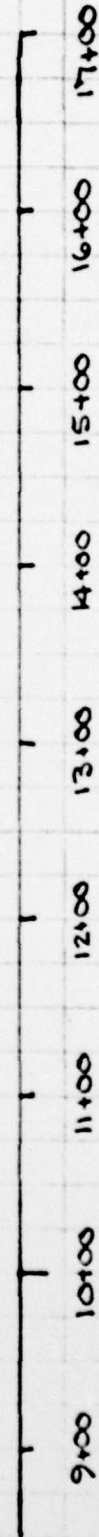


PLATE  
5







APPENDIX

F

Site Geology

## SITE GEOLOGY

### Marcel Lake Dam

The dam at Marcel Lake is located in the Eastern Glaciated Low Plateaus section of the Appalachian Plateaus physiographic province. The geologic structure in the area is relatively simple with nearly horizontal beds of the Devonian Catskill continental sedimentary group underlying variable thicknesses of Pleistocene Wisconsin glacial deposits. The surface materials consist mainly of till, outwash and other rock debris with occasional swamp or bog deposits occurring sporadically throughout the plateau.

No faulting or major discontinuities were noted in the field or referred to in published geological literature covering this portion of Pike County.

**ENTIRE DRAINAGE BASIN  
CATSKILL FORMATION**

